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VIEWPOINT

It has been less than a decade since HYL was “spun off” from its former parent company Hylsamex (which became Ternium after being acquired by the Techint Group). As a separate company and part of Techint’s Tenova business unit, Tenova HYL has experienced a significant revival.

With a clear dedication toward providing direct reduction technology and steel making services to the world iron and steel industries, Tenova HYL quickly moved to make its mark. Having formed a strategic alliance with Danieli & C. of Italy for developing, promoting and building DR plants worldwide under the new ENERGIRO trademark, success was immediate. New projects were signed and built and the latest reformerless version of the technology not only proved its merit but also became the benchmark for direct reduction processes.

Tenova HYL continues being active beyond its core business of direct reduction technology. Based on a long tradition as part of a steel making company, we have accrued expertise in design, operation, maintenance and management of iron ore pelletizing, steel making and finishing lines. These technical services are provided worldwide both directly by us and through other Tenova business units, underlining the synergies provided by Tenova to our customers.

The purpose of this newsletter is to provide you, our customers, with timely information about our technologies and services as well as overall industry trends relating to iron metallics and steel making. You can always find additional information through our websites at tenova.com and energiron.com.

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SUCCESSFUL START-UP OF NUCOR LOUISIANA



ENERGIRON plant now in operation for Nucor is world's largest capacity Direct Reduction Plant, 2.5 Million tpy

Nucor Corporation (NYSE: NUE) announced the successful start-up of production at their 2.5 million mt/year direct reduced iron (DRI) facility in St. James Parish, Louisiana. Production of DRI began on Tuesday, December 24, and has continued at planned ramp-up levels since that time.

The quality of material being produced in terms of both metallization and carbon content has improved very quickly. Within the first 24 hours of operation, output quality (metallization and carbon) clearly surpassed design levels and are at world-class levels.

“We are very pleased to announce this important step in executing our raw materials strategy,” said John Ferriola, Nucor’s President and CEO. “I want to personally thank our team in St. James Parish for their commitment and perseverance working right through the holiday season in achieving this important success.”

Nucor has achieved an operating rate slightly above 95% at its new Louisiana DRI facility Ferriola said the facility is “a little bit ahead” of its original full ramp-up schedule of two to four months.

"The initial output has performed very well at the Nucor mills (that) have consumed it," Ferriola said. The Louisiana facility was able to consistently achieve quality levels seen at its seven-year old Trinidad facility within 24 hours of startup and recently exceeded the carbon-content of DRI produced at Trinidad.

"Our DRI plant represents a major milestone for our company and for American manufacturing," Ferriola said. "This project is a key part of our strategy to produce more of our own raw materials in order to better control costs and maintain our competitive advantage in the global steel industry. This is the largest DRI plant currently operating in the world and the first one to operate in the U.S. since 2009."

The ENERGIRON DR plant now being operated by Nucor uses the ZR or reformerless configuration of the technology, allowing production of 2.5 million tons per year of high quality, high carbon DRI from a single reduction unit.

The plant was designed and supplied by Tenova HYL. It is the largest capacity direct reduction plant in the world. The next largest plants – Suez Steel and Ezz Steel in Egypt and Emirates Steel I and II in Abu Dhabi, all around 2.0 million tpy capacities, also use ENERGIRON technology.

The Nucor DRI facility in St. James Parish, Louisiana, has a complete port facility for arrival of iron ore to the plant as well as shipments of DRI upriver to Nucor steel mills.



HADEED MODULE “D” SETTING PRODUCTION RECORDS



By Andres Villa

A revamping project carried out for the HYL direct reduction module ‘D’ at Hadeed in Saudi Arabia has been successfully completed and the plant is now back in full operation.

The revamping was completed and startup began in July 2013, with the performance test successfully passed at the end of September. The performance of the plant during its first month of operation after the revamping project was very good, and the monthly output now exceeds the original design of the plant in both quality of DRI and production rate.

The project involved removing some bottlenecks from the Hadeed DR Module ‘D’, thus improving its capacity.

The DR plant uses HYL technology to produce direct reduction iron (DRI) for Hadeed’s electric arc furnaces (EAF). Hadeed (the Arabic word for “iron”) is a company of SABIC (Saudi Basic Industries Corporation), an integrated steel producer in the Kingdom of Saudi Arabia, producing rebar and wire rod and is located in the Al-Jubail Industrial City.

The HYL DR Module ‘D’ was designed in 1997 and was originally started up in May 1999. It was designed to use a natural gas with 0.8% N₂. Several changes were executed by the revamping project to use the currently available natural gas of 8% N₂. The changes were: installation of a partial combustion system to enhance the reformed gas availability, installation of cooling gas ejectors to increase cooling capacity, a new steam package boiler and new plate heat exchangers to improve performance of the CO₂ removal system. The reactor iron ore charge system was also modified to use the present HYL standard.

With these changes implemented successfully, Hadeed was able to assure the operation of the new EAF currently in the initial stage of operation. Tenova HYL participated along with the Hadeed EPC contractor supplying all equipment and providing supervision services for the plant revamping project.

EMIRATES STEEL-II IN ABU DHABI UPGRADED TO 2.0 MILLION TPY

By Raul Morales

Emirates Steel of Abu Dhabi, UAE, recently completed the first stage of an ambitious capacity expansion project in which both their 1.6 million tpy Energiron plants will be upgraded to 2.0 million tpy capacities.

The first stage of the expansion introduced the required equipment modifications necessary to raise the production capability of ES module 2 to the new capacity. This modification has been completed and the ES-II DRP has commenced operations at its new capacity level with full success after passing the operations performance test. The plant is now operating at 265 tons/hr, making it the second most productive in the world after the Nucor Louisiana plant.

The first module, ES-I, is now being converted using the same procedures so that later this year, both plants will be back in full operation with a total capacity of 4.0 million tpy of highly metallized DRI for the two EAF melt shop installations at Emirates Steel.

The Emirates Steel Complex, a full turnkey project built by Danieli & C., has become the world benchmark for DR plant and hot charged DRI feeding to an EAF meltshop. The quality of the Energiron DRI being produced and charged hot to the EAFs has brought about significant savings in energy consumption in their Steel Making Plant, while increasing productivity (see table).

ES-II Upgrade Performance Test				
Parameter	Unit	Achieved Results	Target	
Production	ton/h	261,93	250	Min
Average Metallization	%	95,28	94	Min
Average Carbon Content (with oxygen injection)	%	2,56	2,5	Min
Average Natural Gas Consumption	Net Gcal/t of DRI	2,52	2,65	Max
Average Electricity Consumption	kWh/t of DRI	24,14	35	Max
Average Cold DRI temperature	°C	41	60	Max

Emirates Steel recently completed the performance test for DRP-II, after having completed the expansion project from 1.6 to 2.0 million tpy capacity.



THE 250,000 TPY MICRO-MODULE HCI™ PLANT FROM TENOVA HYL

By Angelo Manenti

The tendency in the direct reduction industry has been for plants to grow in capacity to take advantage of economies of scale. This is evident in new ENERGIRON plants – where in recent years new plants have been built for capacities ranging from 1.6 to 2.5 million annual tons in a single unit.

For the small to medium steel mill or foundry, this is of little consequence since steel producers with capacities of less than 1 million annual tons of liquid steel cannot justify the investment for such a large DRI facility. That's why we've developed the Micro-Module – a high efficiency, low investment DR module for producing up to 250,000 metric tons per year of high quality, HY-Carbide Iron or HCI™.

It allows for targeted on site production of HY-Carbide Iron, a high metallization high carbon DRI that can easily substitute both pig iron and high quality, high price scrap in the metallic charge at a substantial savings.

The Micro-Module is based on the fully developed and many years successfully proven HYL/ENERGIRON ZR Technology and already operating successfully since 2010 in Abu Dhabi.

Besides the advantages for a minimill of an integrated HCI plant, the Micro-Module concept presents features, which are reflected in benefits associated to both operating and investment costs. Among these features, the following are the most important:



A 250,000 tpy Micro-Module brings the ideal production capacity to steel producers.

...DESIGNED FOR THE SMALL TO MEDIUM SIZED STEEL PRODUCER

- **Small plant size.** The main hurdle to integrate DR plants in minimills have been the investment cost associated with conventional (high capacity) DR plants, which makes the installation of DR plants in general not attractive for minimills. With this in mind, TENOVA HYL has developed an optimized concept for a low investment cost DR plant with a capacity of 250,000 mt/y.
- **Compact, optimized layout.** The Micro-module has a very compact footprint; the core area is 85 yds. x 98 yds. (78m x 90m) and the reactor tower is less than 180 ft. (60 m). This allows an easy fit in existing minimill brownfield.
- **Synergy** by using existing and/or common utilities/services. Most of the existing infrastructure and utilities; i.e. oxygen plant, water systems, etc., can be utilized and/or modified to serve the Micro-Module.
- **Simplified scheme configuration.** As compared to bigger modules, the Micro-module incorporates simplified systems like charging system to reactor (one leg instead of four), ejectors instead of compressor for cooling gas circuit, compact and simpler material handling, using mobile equipment for the inherent lower material handled/stored, PSA as standard system for CO₂ removal.
- **Optimized process design.** Specific optimization of process parameters, as a result of the industrial operation of the Ternium 4M DR plant and the first Micro-module of EISCO in Abu Dhabi, has been incorporated in the design of the Micro-Module.
- **Prefabricated equipment** (skid-mounted, modular design). There has always been an economic compromise between prefabricated equipment and erection time. For big plants, to transport prefabricated equipment is not normally the best option. However, for this small plant, there is better economical attractiveness to have most systems and equipment skid-mounted thus, reducing erection time.
- **Short erection time.** As mentioned above, this is the result of modular design and prefabrication of most equipment.
- **Low investment cost.** Adapting the latest developments and improvements based on the ENERGIRON ZR process scheme has significantly reduced the specific capital investment.

The plant is also easy to operate and has low operating costs, basically due to its flexibility in processing a wide range of cheaper iron ores (pellets/lumps), and can use up to 100% lump ore.

The Micro-Module Plant is compact and affordable, both in Capex and Opex. Thanks to the abundant availability of natural gas in the U.S., now small to medium minimills can produce HY-Carbide Iron onsite. This virgin metallic iron with no residual elements enables the minimill to meet any steel product specification, and opens the possibility to enter higher grade steel markets.

IMPROVING PERFORMANCE WITH TENOVA HYL STEELMAKING TECHNICAL SERVICES

By Alejandro Rady

Tenova HYL, in addition to offering direct reduction technology, also provides Training and Technical Assistance for all other steelmaking processes, starting from raw materials all the way down to final products either for flat or long products.

For these Training and Technical Assistance services, Tenova HYL has within its organization, people with many years of practical shop floor experience in operation, process and maintenance.

For Training services in Mexico, besides the knowledge transfer done by our specialists, it is supported by having access to similar plants (Ternium) in which the Trainees are exposed to the actual operation of the different steelmaking processes.

For the Technical Assistance services, our specialists apply all their knowledge and experience to support the customer on achieving the results requested by the customer.

These include commissioning, cold tests, hot tests, operation/results optimization, maintenance and quality improvement, among others.

The above mentioned services have been provided for the last 19 years to companies located all around the world.

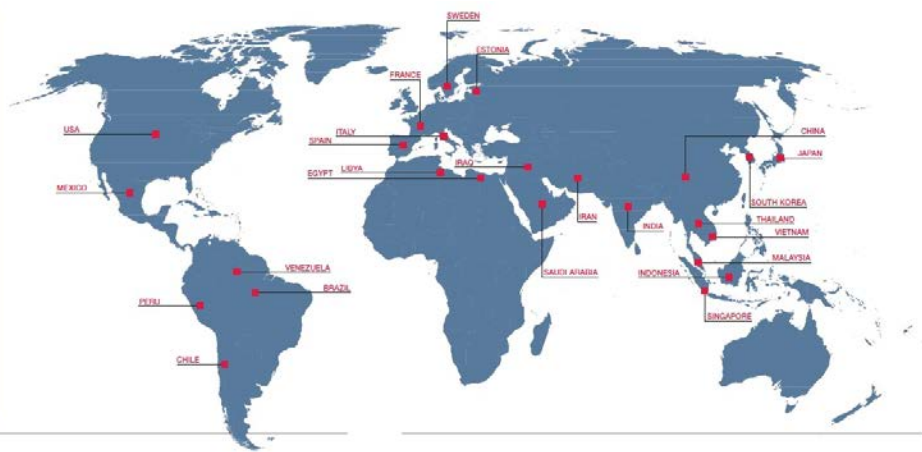
Actually Tenova HYL is supporting Ternium in retraining its operation and maintenance personnel in the DRI and EAF processes of their Monterrey and Puebla plants. More than 500 persons have been retrained in a Process Focused on Safety Training.

Tenova HYL is also supporting other Tenova business units, in this case specifically Tenova Strip Processing, in a Cleaning Line commissioning, start up and acceptance tests and Tenova Melt Shops in an Electric Arc Furnace commissioning, start up and acceptance tests.

TECHNOLOGY TRANSFER SERVICES WORLDWIDE

Tenova HYL has provided over 20,000 man/months of training and technical assistance service worldwide. Tenova HYL clients list includes such major world steelmakers such as Mittal Steel, Jindal, Essar, Harsco, MMK, Nucor and many others.

Tenova HYL has also worked with some of the major plant and equipment suppliers including Tenova, SMS, Daniel, VAI, Brimont and others in providing training to their clients.



CALENDAR OF EVENTS

MARCH – JUNE 2014

Look for Tenova HYL at the following events:

March 18-20

Platts 3rd Scrap and 10th Steel Markets Conference
Chicago, IL

March 19-21

International Iron Metallics Association (IIMA) Spring Meeting
Barcelona, Spain

March 23-26

CONAC 2014 – AIST Mexico Expo and Conference
Cintermex Convention Centre, Monterrey, Mexico

April 7

AIST Pittsburgh Chapter Meeting
Pittsburgh PA

April 28-30

2nd MB DRI and Pellet Congress
Abu Dhabi, UAE

May 5-8

AISTech 2014
Indianapolis, IN

May 17-20

8th China International Steel Congress
China World Hotel, Beijing

May 26-29

2014 SEAISI Conference & Exhibition
Shangri-La Hotel, Kuala Lumpur, Malaysia



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